SCIENCE

A WEEKLY RECORD OF SCIENTIFIC PROGRESS.

ILLUSTRATED.

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A WEEKLY JOURNAL OF SCIENTIFIC PROGRESS.

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All communications should be addressed to the Editor—box 3838, P. O., New York—with name and address of writer, not necessarily for publication without consent.

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Those engaged in Scientific Research are invited to make this Journal the medium of recording their work, and facilities will be extended to those desirous of publishing original communications possessing merit.

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Both questions and answers in "Notes and Queries" should be made as brief as possible; an answer appearing to demand an elaborate reply may be written in the form of an article.

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SCIENCE:

A Weekly Record of Scientific Progress.

JOHN MICHELS, Editor.

Published at

229 BROADWAY, NEW YORK.

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SATURDAY, FEBRUARY 26, 1881.

INDEX FOR SCIENCE.

In accordance with the promise made in our first number, we have prepared an elaborate Index for Volume One.

Genera and species are printed in italics; also the names of recently discovered stars. There is a separate Subject and Authors' Index, the whole having 4576 distinct references. "SCIENCE" thus becomes a valuable standard work of reference, which should be found in every library. The Index has been sent to regular subscribers; others can obtain it on payment of twenty cents.

THE NEW YORK AQUARIUM.

With the closing of the New York Aquarium the city will lose an institution that might have been made a source of instruction to the people, combined with an agreeable place of recreation, and the causes of its failure to be remunerative may be studied with advantage by those who desire to have a permanent public aquarium in this city, thriving on a paying basis.

We observe that the present proprietor, Mr. Charles Reiche, makes the assertion "that such a place is not appreciated by the people." We consider that such a statement has been amply refuted by the very fair amount of patronage received, even at a price for admission which was practically prohibitory to the majority of those who would have visited the place in thousands.

Neither do we believe that the faults of the management can be charged with the failure, and we have as little faith in the other reasons which have been suggested. In our opinion the whole enterprise was killed by being loaded down with heavy expenses, and too profuse expenditure by those who controlled the finances.

Unfortunately, there was too much money at command from the start, and by the time experience of the proper course to pursue had been gained, the capita had been squandered, and the demoralization which finally led to the ruin, had set in.

To saddle the enterprise with a rental of $10,000 a year for the bare ground on which the building stood was to court ruin, but all the outlays were made on the same extravagant basis. Then came the fatal mistake of appealing for support to the few affluent, and making each admission fifty cents, instead of trusting to the multitude who could and would have paid twenty-five cents.

Even under these circumstances we are now told by Mr. Reiche that *for a time it did pay*. We think this very convincing proof that under more economical management and with a less pretentious establishment, success would have been secured.

On behalf of many scientific men, we extend our thanks to Mr. Reiche for the liberal facilities he has throughout extended to those who desired to visit and make use of the aquarium for scientific purposes; to such the place has always been open and a cordial welcome given. Under instructions, the officers in charge have been courteous in offering the fullest facilities for study and freely gave such specimens as could be spared. How little such opportunities have been appreciated and used by naturalists within reach of the institution reflects little credit on those who should have seized the occasion with avidity.

Unfortunately the facilities were too great, and too conveniently at hand to be appreciated, and because they were offered as a gift they were neglected. The New York Aquarium had the benefit of the services of the best professional collectors in this country, and the coast from Maine to Florida was constantly searched for living species of rare and interesting forms of animal life, and yet many naturalists preferred to waste their time and money, travelling hundreds of miles, to obtain objects which could be had at their very doors.

The same results have happened in Europe under similar circumstances. When Mr. Lloyd, of London, was asked if he thought the aquarium at the Channel Islands would answer, he replied, that he feared it was too near home, too convenient of access; for said he, "I have known persons prefer to travel from to the Bay of Naples to collect specimens, which I had in my aquarium at the Crystal Palace."

We trust that steps may be taken to preserve the fittings of the New York Aquarium, and that they may be replaced in some part of the city where a site will be inexpensive, and that a plan may be arranged for maintaining it on a remunerative basis, which in our opinion should not be a difficult matter; but to secure success we should advise the institution to be placed in the charge of some well-known professional naturalist, who could be well named by Professor Spencer F. Baird.

SMITHSONIAN INSTITUTION.

In its annual report for 1880 the Smithsonian Institution purposes publishing a bibliography of American Anthropology for that year. The list will include not only the titles of works in that special branch, wherever issued, but also the publications of American scholars in all departments of this science, and you will confer a favor on the establishment by sending it a copy of each of your works upon the subject published during the year 1880. Should this be impracticable, however, please send a list of your own memoirs and of those of the scientific associations with which you are connected, bearing upon Anthropology, in each case giving the full title, author's name, edition, imprint, size, number of pages, maps, engravings, etc. If the publication forms a part of a periodical or of the proceedings of a scientific association, the fact should be distinctly stated. In the case of separate works, references to periodicals in which reviews have appeared should also be given.

In order to give permanent value to this list and to obviate delay in the appearance of the volume, you will oblige the Institution by complying with its request as soon as possible.

SPENCER F. BAIRD,

Secretary Smithsonian Institution.

WASHINGTON, D. C., February 1, 1881.

SCIENTIFIC SOCIETIES OF WASHINGTON.

THE BIOLOGICAL SOCIETY.—At the Biological Society, Friday evening, February 11, the entire evening was spent in discussing the annual address of President Theodore Gill, delivered at the previous meeting. Dr. White and Professor Ward, in company with the President, reviewed the arguments which have been offered by various naturalists, including Professor Burt G. Wilder and Dr. Coues, for the existence of antero-posterior symmetry in the vertebrates. The conclusion reached was, that, while there are many and very plausible reasons in favor of this view, on the whole, the weight of testimony is on the opposite side. Dr. King gave a description of one or two cases of hermaphroditism which had come under his notice. This was the occasion of an interesting discussion as to the meaning of the term and the possibilities of the phenomenon in the human subject. Professor Ward brought forward the arguments of Haeckel for the establishment of a kingdom of nature intermediate between the Vegetable and the Animal Kingdoms.

THE ANTHROPOLOGICAL SOCIETY.—The Anthropological Society met on Tuesday evening, February 15, Vice-President Mason in the chair. The following papers were announced: "Some peculiarities in the use of moods in the principal Neo. Latin Languages."—By H. L. Thomas. "Aboriginal burial cave in the Valley of the South Shenandoah."—By Elmer R. Reynolds. "Amphibious aborigines of Alaska."—By Ivan Petroff. Mr. Thomas, the translator of the State Department, announced that the object of his paper was to follow the history of the Latin rules respecting the sequence of moods in complex sentences in the languages of Southern Europe, commonly called Romance or Neo-Latin. The author directed attention to the fact that numerous editors of the last few centuries had made changes in the moods of Latin verbs in order to bring them under certain fixed rules from which the Latins had never varied. By numerous citations from very old editions these changes were exposed.

The next point elaborated was the national peculiarties which had manifested themselves in the adoption of Latin rules. The Portuguese, Spanish, French, Italian and Romance proper, had all affected the Latin usages in the use of the subordinate subjunctive, but had done this, so to speak, in their own way: which gives to the subject a special ethnologic value.

The author justly paid a high tribute to the opinion set forth by Professor Fay, in a communication made to the Society last year, that we are not to look in classical Latin but in the old Roman folk-speech for the ancestor of these borrowed forms. During the discussion which followed by Professor Antisell, Dr. Welling and the chair, the interesting question was mooted whether in the advance of scientific certitude the use of subjunctive or doubtful forms were not sloughed off.

Dr. Reynolds gave a brief but highly interesting description of a visit to a cave in Page valley, Virginia, near the celebrated Luray cavern, containing numerous human remains. The Smithsonian Institution had sent out many hundreds of circulars, to every post-office in the United States, but had failed to receive information of a single mound or permanent remain in the valley of Virginia. Dr. Reynolds, in the short space of a month traced twenty-five mounds, ossuaries, forts, ateliers, and bone caves. The paper was illustrated with a large collection of human bones, stone implements, and pottery.

AMERICAN CHEMICAL SOCIETY.

THE February *Conversazione* of the American Chemical Society took place Monday evening, the 21st inst. No papers were read, but a number of interesting specimens were exhibited. Among these was a quantity of that poisonous alkaloid, nicotine, which Mr. William Rupp, one of the curators of the society, had himself prepared. Mr. P. Casamajor, by means of a microscope with an 8-10 objective, showed a simple way to distinguish between pure sugar and that adulterated with glucose. The former crystalizes in large and characteristic forms while the glucuse appears much finer, and as poorly defined cystals. So that when the two are mixed no difficulty would be had in distinguishing the adulterated from the pure, provided a microscope was used.

A large piece of glass painted with Balmain's Luminous Paint was exhibited by Mr. M. Benjamin. This paint was discovered in 1877 by Mr. Balmain, an English chemist, and has recently been brought to this country. It possesses the peculiar power of phosphorescence, or the property of absorbing light during the daytime, and then emitting it in the darkness. It is prepared by calcining oyster shells with sulphur, and treating the resulting calcium sulphide with the proper articles necessary to form a paint.

Its uses are numerous; miners lamps are painted with it, and used instead of the ordinary safety lamp; it has been suggested that screens coated with this paint be used for illuminating purposes along the galleries of mines. Its marine applications are very important. the painting of life buoys, and also stationary buoys, so that they can be seen at night-time, the hulls and rigging of ships treated in this manner might prevent collisions. Divers costumes painted with it are found to yield light after the diver has descended, in fact, sufficiently so to enable him to distinguish quite minute objects.

Tunnels may be illuminated by this paint. It has been successfully employed to light railway cars at night time. The time of night is readily told from clocks and watches whose faces are coated with this substance. Signs and advertisements are among the many uses to which it may be put. More appplications will suggest themselves to every one.

M. B.

N. Y., Feb. 22, 1681.

ORGANIC HEALING POWERS.

A LECTURE BY RUDOLF VIRCHOW.

[*Translated from the German by the Marchioness Clara Lanza.*]

Andrew Jackson Davis, who is called the "Great Prophet" by his German adherents, thus begins a chapter in his "Harmony"[1] entitled "The Philosophy of Disease:"

"The improvements and progress which have been made in pathological science, are not by any means in keeping with its actual value and antiquity." And then he adds the following:

"The age of a science or doctrine has but little to do with its reliability, importance or progress. Indeed, the great maturity of any doctrine is almost a positive proof that it originated in ignorance, superstition and error."

The "Great Prophet," who conceives all his ideas without the aid of study, and who, moreover, by a peculiar direction of his will, turns from the confining influences of the material world in order that he may enter the "highest state," has entirely overlooked the fact that the ancient science which he disdains, proceeded from precisely similar revelations as those which he produces with so much pride.

Welcker, in his magnificent work upon the "Art of Healing Among the Ancient Greeks,"[2] has given very impressive descriptions of the Epiphania which occurred more than 2000 years ago in the Temple of Æsculapius, and they now possess a double interest in regard to American Spiritualism or spiritualism of any kind, (if we consider for a moment how philologists a quarter of a century ago investigated the question) as to whether the so-called incubation of the Æsculapians was identical with modern clairvoyance. Those seeking to be cured from disease obtained revelations while sleeping or dreaming in the sanctuary of God. Hence medical literature arose, for the afflicted wrote a description of their cures upon the pillars of the Temple or else upon certain consecrated tablets, and from them the forefather of medicine, Hippocrates, collected in the Temple of Kos those memorable "Predictions" which can be considered one of the principle sources of our scientific knowledge.[3]

Did all this spring from "ignorance, superstition and error?" The point perhaps cannot be contested, but it contains, nevertheless, a large portion of veritable experience, and Hippocrates, not withstanding his direct descent from heathens was a too critical and (remarkable as it may seem) a too worldly person not to expose everything which partook merely of a sacerdotal or superstitious character.

In his writings and in those of his followers, there is nothing supernatural to be found. The gods no longer heal the sick. Nature does it, and nature, moreover, does not act in accordance with instantaneous inspiration. On the contrary it is subject to "divine necessity," or rather we should say to eternal and also divine laws.

Since the remote period before referred to, opposition has been openly declared between science and superstitious therapeutics. The latter even now has certainly not died out. The countrymen of the "Great Prophet," that is to say, the medicine men among the North American Indians still boast of their immediate intercourse with the Great Spirit, and perhaps it is the proximity of these people which promotes the increase of spiritualism throughout the United States. One of the nations of North Asia[4] beats a magic drum, while a certain people in South Africa blow an enchanted trumpet in order that the evil spirits of disease may be dispelled. However, we do not need to go so far for examples of this kind. In our immediate neighborhood the traditions of heathenism rise up secretly and flourish, while superstition concerning mystical healing powers is capable of continually bringing forth fresh fruit.

Conjuring, however, during the past century has rapidly declined. I, myself, remember that during my childhood many people of the middle classes where I lived believed in fire conjuring. Even at the present day you will scarcely find one German city where the worth of a fire brigade is not undervalued on account of the possible termination of a conflagration may have in consequence of conjurations.

In one of those old Greek writings, which, on account of its age, has been attributed to Hippocrates, and has for its subject Epilepsy, or the divine disease[5], which, at that time was treated by magic, the author says that those who conferred divine names upon diseases were merely magicians, purifiers, pious beggars, and coxcombs, who gave themselves the airs of God-fearing individuals, but who, in reality, knew no better how to conceal their perplexity than by taking refuge behind the deities.

How many years have passed since then! The Olympian Gods have been shattered for ages; even Christianity has by degrees become an old religion, and yet with it all, epilepsy has not ceased to be the subject of conjuration and magic.

Superstition, no matter how degraded, will always outlive faith. The fathers of the church belonging to the first Christian century, fought and struggled in vain against the traditions of heathenism. Chrysostom said that a Christian had better far endure sickness and death than have his health restored and his life lengthened by means of amulets and exorcisms. But the Christians would not listen to this voice, and in the end the Church was forced to make amends. When it erected its places of worship upon the very ground where formerly were temples and sacrifices, and changed the heathen festivals into Christian ones, new methods of supernatural cure were instantly put into practice. Even the kings by God's favor did not hesitate to adopt this sort of accomplishment—not only the most Christian kings of France, but also those of England, until the first representative of the House of Hanover mounted the throne, Catholic and Protestant alike cured scrofula by discourses and sundry calming influences. At that time the disease was called "Kings' Evil," just as epilepsy was termed the "divine disease."

Such obtuseness in regard to traditional superstition may seem astonishing, not to say alarming. It lies, however, deeply imbedded within the human mind. How long has the fear of ghosts at night been kept up, while scarcely anyone dreads spirits in broad daylight? According to the testimony of Signoria Coronedi, people in Bologna burn daily the combings of their hair, to the end that no witchcraft can be perpetrated upon them, and I remember distinctly that when, as a boy, my hair was cut, the clippings were carefully thrown into the stove.

The inhabitants of some of the Malay Islands fear that a magician will have their lives in his power should he take the remnants of their meals and burn them in a peculiar sort of ashes called *Nahak*. Everywhere we find the same childish tricks performed by men in the lower orders of life that they may create fictitious personalities, endow living or inanimate bodies with imaginary powers and trace out the superior force of spirits in purely natural incidents. This is nowhere to be seen so plainly as in the origin and cure of disease, and if the source of various maladies is referred to enchantment, possession or dispensation, it arises mainly in regard to the cure to be effected.

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[1] Andrew Jackson Davis, M. D. *Harmonious Philosophy Concerning the Origin and Destiny of Man—His health, disease and recovery.* Leipzig, 1873, p. 93.

[2] F. G. Welcker, *The Art of Healing Among the Ancient Greeks. Bonn*, 1850, p. 95, 112, 151.

[3] *Magni Hippocratis Opera Omnia*, Edit. Kuhn, Leipzig, 1825, Vol. 1, p. 234.

[4] O. Peschel. *Knowledge of Nations.* Leipzig, 1874, p. 274.

[5] Hippocrates. *De Morbo Sacro.* Welcker, p. 587.

The reason can easily be comprehended. While we are familiar with the natural causes of maladies we are still in want of a well organized acquaintance with their natural preceding incidents. By taking an unprejudiced view of the case, we can easily see that even Hippocrates had recourse to nature in curing diseases. Physics, he designated the basis upon which the healing incidents rested, and there can be no doubt that this term was the same to him as is to us the tautological epithet of the "physical nature of man." If you read attentively the part in which he mentions this, you can no longer doubt that he had the whole question of man's bodily formation foremost in his mind. Taken in this sense, the healing powers belonging to the body itself must consequently be natural or physical organic forces.

The idea, however, was in a certain measure a prophetic one. Knowledge at that time was not sufficiently extensive to admit of, or to supply any explanation of it. Even the most favorable and clear sighted observations relating to natural incidents in healing, led to nothing more than a superficial, and to a certain extent, brief conception of the events. This sufficed certainly to establish their situation, and also furnished abundant cause for application of remedies at certain times and on particular parts of the body, remedies which seemed adapted to facilitate the natural course of events, to favor it, or in case it remained concealed, to bring it forward.

There have been numerous attempts to explain all this. One school after the other produced its doctrines, but each one of them was based upon imperfect or voluntary suppositions. Each new step of progress in the knowledge of various occurrences which take place in the human organization overthrew the opinion under consideration and produced another. Of course this did not conduce to strengthen faith in regard to scientific medicine.

It was only during the period of spiritual inactivity when nature's perceptions remained for a long time unchanged as in the early portion of the middle ages, and the Church as well as Medicine adopted natural science in its system of teaching, that medical doctrines gained for themselves the recognized character of stability. It was then that the physician attained aristocratic honors. However secondary schools then arose and dilettanteism pushed forward into existence. So it was at the time of the German revolution, the French revolution and the formation of a new German kingdom.

At no period whatever has mysticism been wanting. A peculiar form of it deserves to be especially mentioned. It is called mystical calculation; its origin lies buried in the most remote practical teachings. Hippocrates himself, observing a country which up to this day is shunned on account of its malarial influence, has established with minute exactness the duration of the feverish maladies which arose from the marshy districts with peculiar regularity. He not only ascertained the precise duration of the fever, but also the days when a decided crisis would appear. The numbers acquired served to denote when the treatment should be discontinued as the critical days, the 7th, the 11th, etc., designated the proper time for the administration of remedies. In this way the calculating system became celebrated, and as it was made a subject of universal contemplation before the days of Hippocrates by the various philosophical schools, we cannot be surprised that those who succeeded them thought to recognize in the theory more than mere expressions concerning the legitimate relation of things to each other.

During the Middle Ages astrology formed a close alliance with medicine, and the constellations occupied the places of the ancient oracles. But even subsequent ages have repeatedly had recourse to conceptions which nearly approach those of the Pythagoreans. Particularly towards the close of the preceding century, discoveries in the departments of electricity and magnetism caused the biological sciences to adopt the theory of polar attraction, a doctrine in which the heterodoxy of animal magnetism, and its companion spiritualism is firmly rooted. In the Pythagorean philosophy, a two-fold existence was supposed to be at the root of everything, and the circulation of this doctrine has resolved itself, so to speak, into the "Great Prophet" of America, according to whose conception Providence is a moving substance formed of positive and negative proportions, and which acts upon matter in different ways through the agency of the number 7.

Among all these attempts to grasp the phenomena in a determined manner, an effort comes to light which is in every way worthy of recognition. It has been shown that the human intellect has no more a universal and spiritual form which can establish the relation and conception of things, than it has a material one. Calculation produces the definite value by which we are enabled to assign things to their proper places. It is for this reason that intricate natural sciences, physics and chemistry partake every day of a more mathematical character. The descriptive natural sciences follow timidly in their footsteps, and even physiology and psychology have already been made to travel over the same road. How then, could medicine escape?

However, the numbers 2, 3, 4, 7 and 10, do not suffice to explain the infinite multiplicity of things, even if the combination of ten numbers serves to account for each calculation. Every reckoning about actual things rests upon observation and not upon inspiration. The more difficult the calculation, the more complex must have been the preceding observation which went to supply the elements of the reckoning. This is true, earnest work, such as no one individual is capable of producing. One workman assists the other, and one generation helps another, not only in transmitting results, but also their aim and object.

It will be a difficult task, nevertheless, for any generation to recognize self-acting forces in numbers. If two objects attract each other it is not owing to the things themselves. And there is no number in existence which possesses healing powers, and no talisman compounded of numbers which possesses active force. The numbers supposed to play an important part in disease only serve to give those versed in art the means by which they may discover the time and duration of the malady and arrange their mode of action accordingly.

But just as Astronomy is incapable of moving the moon or planets by means of numbers, so is the physician unable to produce any effect upon the course of disease or recovery by the same process. Numbers are not remedies, for remedies are actual things, which stand at the disposal of medical art; are actually applicable, and which possess in a certain sense real powers of healing. When we consider them, however, we come to a lengthy and apparently increasing contention which is embodied in medical history in the names of physiologists and technologists. Physiologists are those who seek healing powers within the physical organization itself, while technologists think to recognize them in such means or influences which exist independently of the patient and are directed toward him.

It is true that the physiologist does not altogether despise remedies, but they only serve, in his opinion, to set the organic powers at large. The technologist, on the contrary, intrenches upon the organism. He forces life into artifical conditions. He "orders" and "prescribes" where the physiologist is satisfied with existing circumstances and comes forward as Nature's servant.

Of course a long time has elapsed since the controversy between these two schools was at its height, but in some recent accounts it appears again, not only in specified cases of treatment, but also in a general sense.

Not many years ago blood-letting was a daily occurrence in every hospital, and indeed in almost every private practice. Now it has become so rare that young physi

cians are scarcely acquainted with it. When I was a young hospital assistant I was frequently forced to perform cupping four or five times in one morning. Singularly enough the change came at a time when we were the least prepared for it. In cases of inflammation of the lungs, where the most audacious blood letting was considered an almost irrefragable means of restoring the patient, they began in the Universal Hospital at Prague to observe the natural course of the disease without the application of any remedies. They contented themselves with giving the patients plenty of fresh air, good attendance, greater cleanliness than they were in the habit of getting and strict dietetic surveillance. In the way of medicine, they got nothing, and yet very favorable statistics were obtained. In this way physiology gained a victory over technology, and at the first step reached the highest form—nihilism.[6]

Since then a certain reconciliation has taken place. A firm conviction arose that hospital practice could not merely be influential to private practice—that the hospital, with its manifold contrivances, its order and regimen, possessed provisos and remedies which in a private family, even a wealthy one, could only be imperfectly established, or else not at all—and finally that the nihilism of the hospital physician could not be transmitted to families.

Of course, both physiology and technology will continually enlarge in the future, the more so as experience gains new perceptions and increased power. This, we all know, is inevitable, and the public, which might justly reprove medicine for its scientific changeability, should bear in mind constantly that it is the fate of humanity to be fickle, not only in regard to science, but also every other matter, from the State to the Church. We can only hope that changes everywhere will be made with as much honest intention as they generally are in regard to science.

It would, perhaps, be possible to check trivial fluctuations if people could only agree better as to proper healing objects. This is precisely the point over which scientific men find it so difficult to attain to a uniformity of opinion. When a physician is called upon to cure he has the case before him, represented by the patient— a unity so to speak. And yet the malady itself gives the impression of another unity. It has the appearance of some strange being which has implanted itself in the individual. It has been not improperly termed a parasitic organism, which lives in or upon the system of the patient. Numbers of times it has been asserted that a strange existence has penetrated into the sick man and "possessed" him. All these ideas unite in the practical task of expelling the disease by driving it forcibly from the body. Is it not perfectly evident that a double existence takes the place of the former unity? Can any conclusion be drawn from such premises, except that the "case" must be regarded as dualistic? If the physician has the patient *and* the disease before him; if he is to separate the one from the other; if the practical endeavor is to act *against* the disease and *for* the individual, can it be a question of a unitarian conception?

Truthfully speaking, such an idea has never properly existed. Even in cases of sickness which were termed rather figuratively universal, it was always understood that a more or less large portion of health should remain undisturbed. It was this remainder that caused "reaction" according to some schools, and led the battle against strange intruders. Paracelsus, in the Middle Ages, expressed these thoughts in the most worthy manner. Let us take up the point and imagine a defensive battle whose seat of action is the human frame. Who are the combatants? On one side we have the disease, in the other the healthy portion. The latter, of course, can go forth with no other weapons of defense and attack than those previously possessed. Where can new ones be found? The means of resistance must necessarily spring from the physical system itself. Thus far the ideas are simple enough. But if we see that the struggle is carried on according to a military principal, that it has a tendency to cure, and that the means of reaching this end are apparently, purposely and systematically chosen and put into action, what power shall we consider the decisive one? What is the leading principle, and where are we to look for it? The generality of physicians say with Hippocrates, it is Nature. But do we not, so to speak, run around in a circle when we first of all call the legitimate formation of the body nature, and then again have recourse to the same term when we wish to explain how this arrangement resolves itself into a systematic unitarian course of action? Have we not a substance to deal with in the first case, and a force in the second—and an organized force too, a force with designs and purposes—a species of spirit in fact? Paracelsus was firmly convinced on this latter point. He designated the decisive power the *Archæus maximus*, which corresponded to *spiritus rector*, or leading spirit.

Georg Ernst Stahl, the celebrated clinical lecturer, in the beginning of the past century, went a step further. He set up the soul itself, the *anima*, as the decisive principle. But at that time the philosophy of the unknown was not yet invented, and it was difficult to demonstrate that the hitherto thinking and conscious soul could here work in an entirely unconscious manner, and yet be systematic withal. It was also extremely hard to trace the diseases of cattle, the *morbi brutorum*, or the maladies of plants to a soul, if we did not wish to run the risk of losing the conception of the term by this extensive generalization.

Toward the close of the past century we became more and more inclined to admit the existence of an organic force secondary to the soul—some called it vitality, others natural healing power. Those inclined to the former opinion endeavored to unite a given relation of the healthy organism with an effort directed upon itself. Those who adhered to the latter idea were firmly convinced that a peculiar regulating force existed.

At all events, the much sought for *unity* was driven further and further into the background by the sudden appearance of these new forces. There was no longer merely a *dyas*, but a *trias*. The disease, the remaining healthy portion of the body, and the particular force which ruled it. And no matter what special term was employed to designate the latter, it always partook of a distinctly spiritual character. Many attempts were made to reduce it to a scientific quality; to construct it according to a physical dynamic system; to interpret it as a particular form of electricity or magnetism.

However, as soon as the matter was entered upon seriously, and all the systematic plans and workings investigated, natural science became instantly transformed into a spirit.

Nevertheless, assistance was frequently deemed necessary. The course of the struggle was observed more minutely, and if it was found to be too weakly conducted either by vitality or natural healing force, endeavors were made to strengthen both, or at least to incite them to greater activity. But if the battle was found to be sustained with more force than necessity required, pains were taken to moderate and reduce the action. Thus arose a classification of conditions pertaining to disease—asthenic, sthenic and hypersthenic, names derived from *sthenos*, signifying strength.

It would lead us entirely too far from our course, should we attempt to expound the history of the various healing systems. It may suffice to say that every one of them, to use a common expression, has left its traces behind, and that an acute eye can easily detect them. According to our present ideas all these systems rest upon an erroneous conception of life and disease, inasmuch as

[6] *Archives of pathological anatomy*, 1849, Vol. II., p. 14.

they endeavor to attribute a more or less personal significance to each of these terms. The perception thus becomes figurative and typical.

Modern medical science has utterly renounced this tendency to personification, where the pre-supposed force does not correspond with an actual demonstrable body. It further separates simple forms from compound ones, although, according to the mode of observation they may possibly produce the impression of unity. For instance, the human organism appears to be a compound form, although we may correctly apply to it a personal expression. Each particular cell can be interpreted as a personality, for they are all self-existing and self-acting, and their power emanates from their own construction — their *physics*. In this sense the human body is not a unity in the strict *material* meaning of the word, but on the contrary a plurality, a collective form, and in a certain degree, a state. There likewise exists no one force which rules it and establishes its action, but on the contrary, a coöperation of many forces which are inseparable from the living element. Even the greatest phenomenon in human life, the spiritual I, is therefore no steady, immovable capacity, but a very changeable one.

If the human organic structure appears to us a unity it is chiefly due to three circumstances: First, in the construction of the vascular system and in the blood circulating through it, there is another perfectly accorded system which pervades the entire body, effects the material intercourse of the various substances, and constitutes a certain dependence of the parts upon the blood. For a long time, therefore, people looked for the source of life merely in the blood, and endeavored to explain all the incidents pertaining to disease and cure by means of the blood alone. When it appeared to be impure it was refined with inappropriate substances. When there was apparently too much or too little, it was drawn off, or attempts were made to produce it. In the second place, in the formation of the nervous system to which man's highest powers are attached, namely, the intellectual, we find an organization extending throughout the entire body, converging to the brain and spinal marrow, and which on one side is qualified to adopt outward impressions and conduct them to the great centre, while on the other side it possesses the capacity to eject any impulse directed upon other portions of the body by causing them to make particular assertions of activity or else to limit them.

Diseases such as fever, for instance, can only become intelligible by referring the great number of collected phenomena which come under this category, to the nervous system.[7] What wonder then that there is continually a fresh attempt to explain disease and cure by means of the nervous system?

But there is still a third point. This is the enormous mass of tissues of which the body is built up. The compound construction of countless numbers of cellular elements which are organized in the most varied manner, and are capable of producing the greatest diversity of results. Many of them, such as the muscles, appear in a high degree to be simple bearers of strength. The blood would be an immovable mass if the muscles of the heart and vessels did not circulate it mechanically. Other tissue formations, as the glands, superintend various things, the act of secretion, for instance, which represents a no less declaration of force. But each of these regulations, every one of these so-called organs is again a plurality compounded from endless elementary organisms, the cells. And when we see that the nervous system is just as complex, that the vessels, the heart and the blood are likewise compound combinations, it is well proved that every observation which does not apply to a compound element must be external and superficial.

If such a conception upon first sight results in a detachment of the body, a total breaking up of the perception, a further contemplation will show that these innumerable elements do not exist in juxtaposition. Accidentally or indifferently, they belong to each other on account of their common descent from a simple element which insures a certain original resemblance and relation among themselves just as there is among the descendents of one family.

[7]Virchow. *Fever. Four Discourses upon Life and Disease.* Berlin, 1862, p. 129.

This is the "divine necessity" of Hippocrates in its modern form. It does not merely assume the material of all elements to be one organism, but it also concludes that it must form certain combinations by means of which the effect of the different elements through each other produces a legitimate arrangement of the general principles.

Such organizations undoubtedly occur in the vascular and nervous systems, and they exist also in the great masses of superfluous tissues. For even as the vessels and nerves influence these latter, so on their side they influence them. Thus arises a reciprocity of effect which can be beneficial or otherwise, according to circumstances.

As long as the effect is beneficial, so long will the organization appear to be in harmony. And we can experience it in our consciousness as a sensation of well-being. If the effect should be injurious on the contrary, we say disease has entered the system, and we experience a feeling of discomfort. These sensations do not relate solely to bodily conditions, but to those of the mind, also. There is moral as well as physical indisposition.

In a figurative sense, we might say *equilibrium* instead of harmony, and *loss of balance* instead of discord. In many cases such designations would have an actual significance. The distribution of the blood is arranged to a certain extent, according to simple hydro-dynamic principles. An increase in one part necessitates a decrease in another. The electricity existing in the nerves can be interpreted in a purely physical sense. Here are tensions and accumulations, there evacuations and discharges of electricity. Even the usual incidents pertaining to the growth of the tissues provide us with numerous examples. If one part increases in strength, another diminishes. A suitable instance of these antagonistic phenomena is given in the difference of incidents pertaining to growth between the male and female sexes.

From these remarks we alresdy see that any disturbance of the harmony or equilibrium does not merely affect the common sensations, and therefore the nervous system, but also other parts of the body, and it can be readily understood that one disturbance will act upon this portion, and another upon that, etc.

All the parts do not stand in equal relation to each other, and those whose mutual dependence is the closest will, of course, be the soonest affected, while the others will be influenced in a lesser degree or else not at all. We designate the closer relationship as *sympathy*.

All these connections exist uniformly in sound, healthy bodies, and in order to explain them, we have no need to refer to the soul, vitality, or any other special spiritual force. When a diseased disturbance of the equilibrium occurs, they represent what we call *organic healing power*.

In order to obtain a full comprehension of this it is not actually necessary to say much concerning the healing itself. The theoretical discussions which have taken place in regard to this point, and the practical inferences derived from them, have often become very much confused inasmuch as entirely opposite relations have been drawn together by means of them.

The old word medicine, which is almost synonymous with our modern term therapeutics, led to the misunderstanding that the entire practical energy of the physician should be directed to one particular point of the bodily condition inasmuch as his chief task is to cure. A closer reflection will show, nevertheless, that this is by no means the case.

Only a certain portion of medical power, although it

may be the greater part, has reference to the curing of disease. Important branches of medicine allude to circumstances of sound health supervised by the physician in order to prevent disease. Every year our activity in this respect increases.

Besides the removal of the various causes of disease there is another cure which we designate as the *curatio causalis*. A foreign body such as a bullet, a glass splinter, etc., penetrates into the organism and remains there. Frequently, if not always, the removal of this body is the proviso of a cure. This of itself, however, is not sufficient, for the cohesion through which the foreign body passed must first be united, and the natural connection re-established, before the actual restoration can be acknowledged.

Very often restoration is spoken of when the case in question consists merely of a disturbance or a simple deficiency. If a person breaks his leg he is not ill. He cannot walk, of course, and an actual malady can proceed from the fracture if the surrounding parts become inflamed and the nerves excited. But the fracture itself is no illness, although it may become the cause of one. In spite of this, however, the sufferer always hopes to be "cured" by the physician.

Now it is unquestionably true that the same principle of observation cannot be applied to all such cases, otherwise we should become hopelessly embarassed. A broken knee will never set itself; therefore the physician is not to rely at all upon nature but simply upon his own skill; but he does not occupy himself with the phenomena by means of which the fracture will be re-united. That happens by itself. The medical influence in question is certainly technological. It is by means of force that the physician brings the pieces together in a position which as nearly as possible corresponds to the natural one. It is by means of force that he holds them thus. But all that is not a cure, but merely the stipulation for one. The broken part finally grows together in a very bad shape, and the re-establishment of the connecting portions occurs only with a very unfavorable position of the fracture. Nature in this case works most powerfully.

Every restoration of a broken bone is also physiological, and the physician only endeavors to let it occur undisturbed and under the most propitious circumstances. This "only" is of very great importance to the patient, for a fractured bone which heals crosswise or crookedly can infringe upon the use of a limb for life. But when we come to investigate all the theories of healing we must remain firm in stating that recovery from fracture is not caused by the physician. *The cause of the cure is due to the surrounding tissues.* They produce a new tissue, which forms over the scar.

We now come to *actual diseases*. They are not mere disturbances or yet definite conditions. An actual disease is an incident, also a succession of conditions, one preceding from the other and affecting vital parts. No lifeless object, no dead body ever becomes subject to disease. An animal or a plant can become diseased, but only while they are alive and only in such parts as are endowed with life. Therefore, every disease is a demolition to sound health, for the same part cannot at once be sick and well. Disease is also an incident pertaining to life. We call those incidents disease which deviate from the typical form of life and which are at the same time affected by the danger to which they are exposed, for disease strives towards death, be it local or general, and, consequently, it struggles against health.

If disease is incidental to life, it must be allied to certain living portions. Therefore we say the disease is "seated," and it is frequently one of the physician's most difficult tasks to discover precisely where this seat may be. But I must correct myself. In many cases the disease is located in several places. If a person has inflammation of the lungs, he usually has a violent fever in addition. In this case the inflammation is situated in the lungs and the fever in the centre of the nervous system —two entirely different places. Is all this one disease? Even at the beginning of the present century inflammation of the lungs was put under the category of fevers. Now it is considered as local inflammation. Still, it is the fever principally that is treated, while the inflammation is left to Nature. I will not enter into the fact that among many people who suffer from inflammation of the lungs, the stomach and kidneys also become diseased. What I have already said will suffice to show that the mere investigation made to discover the location of the disease leads us from the idea that it can be a unity. Unity only exists in so-called imaginary maladies. It is entirely figurative, a simple fancy, an abstract. In reality, most diseases are distinct pluralities, some existing in which the number of locations is countless.

It remains further to be said that in reference to diseases the word "cure" has many significations. If the term in plain language means wholeness without injury, it should designate the entire and complete re-establishment of the condition. Such an interpretation as this speaks badly for technology. If one has a tumor on the knee and the leg is amputated, curing denotes none the less a complete reestablishment. But it does not always agree with physiology either.

There is scarcely a single form of inflammation of the kidneys which admits of complete restoration; hardly one example of inflammation of the brain which does not always leave certain defects. These diseases therefore, are cured but imperfectly, and yet we may say the patients are quite restored because in spite of the deficiencies, new relations and connections take place in the body which cause the equilibrium of the actions performed.

As an example of the most perfect cure that we know of, I might mention inflammation of the lungs. Although it happens that in the course of a few days five, eight or even ten pounds of matter are deposited in the lungs through which the air inhaled should penetrate, we see, nevertheless, that again within a short time the entire mass is loosened and gradually disappears. This is the consequence of mere natural circumstances. But it requires only trivial aggravations, insignificant want of foresight, slight renewal of deteriorating causes, to interrupt this natural incident; then no relief can occur. On the contrary, the masses of matter remain firm like dead material; they break in pieces; the tissue surrounding them becomes impaired and thus the first step is taken toward that insidious occurrence called consumption. Therefore, the timely advice of a careful physican is very important even if he does not cure, and consequently no one should confidently imagine that all can be satisfactorily arranged independently of him.

Every incident of disease arises either from a defective nutrition or formation, or else from some disturbance of the local actions. A compound disease frequently includes all of these reasons at once. Defects of nutrition and formation are generally classed under the category of *organic imperfections*, because in both cases local alterations take place in the organism. For this reason the equalization of the disturbances occurs generally very slowly. The defects can only be removed gradually, and the normal condition established by degrees. Functional imperfections on the other hand can often be removed in a moment, because the inward construction does not change and the local action is altered merely by unusual excitation or oppression. The more the disease is confined to functional blemishes, the quicker it can be removed.

In any case whatsoever, the cure is obtained by complete restoration of the bodily harmony. It consists of a balancing and regulation of the disturbed relations, and indeed, an equalization through inward bodily resources. The healing powers are situated in the vital portions of the organism. These parts nourish themselves, and produce adequate conditions. They bring forth actions

which serve to direct, relieve, and repair certain defects of the equilibrium. Even when the physician's utmost power is exerted, when the part in question is cut off or destroyed, then also, restoration of the bodily equilibrium is necessary before any tolerable result can be produced. Also, when the healing powers remove certain imperfections, when an acid is neutralized by an alkali, or when a dormant faculty is roused into fresh activity by any excitation, the cure can only be perfect if the natural relations return again, or else if new ones are formed. Every outward effect is only a means by which to lead the inward formation of the body to free and regular action.

No physician can trust wholly to nature, but neither can he produce by art that which takes place naturally in the body. That is the work of the organic healing powers. Every medical man must rely upon their efficiency, but at the same time he has no right to sit idle with his hands in his lap in consequence. On the contrary it is frequently necessary to employ the most forcible interference in order to regulate the action properly. In particular diseases, how much nature is able to perform, and how much the physician is compelled to do, can only be ascertained by personal experience, and can be determined *a priori* by no theory. On the other hand, how far, in certain cases, medical treatment must extend, and how far the natural course is to be influenced by the physician, is not merely a question of experience, but frequently one of scientific value, which only an educated and cultured physician is capable of undertaking. Experience alone, in the medical world, produces only adventurers who perhaps may succeed now and then, but for whom self-reliance is always a risk. Such experience as is led and regulated by Science alone is capable of removing all barriers, and able to designate the realm in which nature and the physical organic forces have the supreme command.

SEPARATION OF CADMIUM AND ZINC.—In a memoir inserted in the *Annales de Chimie et de Physique* (Series 4, vol. 30, p. 351), M. Riche described a process for the determination of zinc, either by the decomposition of the acetate or by the electrolysis of the solution containing sulphuric acid. Several researches on the same subject have since been published by different authors. MM. Beilstein and Jawein, whilst confirming the results of Riche, employ the following process:—The nitric or sulphuric solution of zinc is mixed with caustic soda until precipitation ensues, and then with potassium cyanide till the precipitate is re-dissolved; the electrolysis is then effected with four Bunsen elements. The determination of cadmium has been effected by the same chemist under the same circumstances by means of the current from three elements. M. Millot has recently given a process for the determination of zinc by electrolysis of a solution of this metal in potassa. M. Edgar Smith obtains a precipitate of metallic cadmium by passing a strong current through a solution of the acetate. These procedures have the defect of not serving for the separation of cadmium and zinc, as the two metals are precipitated simultaneously. They may be separated as follows:—The solution containing the two metals in the state of acetates is mixed with 2 or 3 grms, sodium acetate, and a few drops of acetic acid. The current from two Daniell elements is then passed through the solution as described by M. Riche in his memoir. The cadmium alone is deposited in a crystalline layer at the negative pole, the zinc remaining in solution. The process requires the aid of heat, and requires three to four hours for quantities of 0·180 grm. to 0·210 grm. cadmium, and as much zinc. The deposit is effected in the crucible, and the liquid is then drawn off and serves for the determination of the zinc, according to M. Riche's process The deposit is washed first with water, then with alcohol, dried, and weighed. If the zinc and cadmium are present as sulphates the author recommends precisely the same method. Or the sulphuric solution may be mixed with ammonia and ammonium sulphate.—A. YVER.

MANUFACTURE OF YEAST WITHOUT ALCOHOLIC FERMENTATION.

A method of manufacturing yeast without alcoholic fermentation, and without the formation of subsidiary products has been patented in England by Dr. J. Rainer, of Vienna. The process is carried out in the following manner:—The vegetable albuminous substances in the corn cereals or other vegetables, or such refuse of industrial establishments as bran cornings, malt residuum, gluten, and the like, are extracted with the aid of from 15 to 20 parts by measure of water, made slightly alkaline. They are then either peptonized by adding an excess of lactic acid (about 4 per cent.) or mineral acids (about .25 per cent. of phosphoric acid, or about .4 per cent. of either sulphuric acid or hydrochloric acid) at a temperature of from 55 to 100 degrees Fahrenheit, or they are at once macerated in dilute solutions of the above acids and simultaneously converted into peptone. A portion of the albuminous substances (from 5 to 10 per cent. of the total weight) in the dried cornings will be already transformed into peptone by the process of vegetation. The albuminous substances in cereals, maize, or other vegetables, and in bran and malt residuum are transformed into peptone by the addition of diastase. In order to effect the conversion it is sufficient to add to one part by weight of the albuminous matter when dry, one part by weight of dry malt, or five parts by weight of cornings. As stated the liquid in which the albuminous matter is to be transformed into peptone must contain lactic acid (4 per cent.), phosphoric acid (as much as .25 per cent.), sulphuric acid or hydrochloric acid (about .4 per cent.), because the presence of an acid is absolutely necessary in the process of converting these substances into peptone.

A temperature of about 100 degrees Fahrenheit is the most suitable for the conversion of the substances into peptone, and a period of from 18 to 20 hours will be sufficient to effect it. It may, however, be also carried out at lower temperatures during a correspondingly longer time. In working cornings it is superfluous to add malt, because the diastase contained in the cornings is more than sufficient for the process of conversion into peptone. Therefore it is only necessary in this case to use one of the above-named acids in the proportions given. The slimy pectates contained in the cornings as well as in other materials are dissolved by the combination of diastase and acids. When the preparation of pure peptone is required the pectates may be separated by an endosmotic apparatus or dialysator, in such a manner that the peptone is dialysed through proper membranes in water, while the gelatinous pectates remain as a residuum. The acids are neutralized by means of soda, or by saturating the liquid with basic phosphate of lime. The prepared peptone liquid, with or without a percentage of sugar, may be shipped as a saleable article, or it may be delivered in a dry state, or as a syrup or extract obtained by boiling the liquid down in a water bath, by steam, or preferably in a vacuum. The liquid containing peptone may be separated from solid matter (hydrocarbons, vegetable fibre, or the like) by simple extraction, maceration, or pressure, or by centrifugal action, or it may be carefully cleaned by filtration or settling. It is advisable, however, before cleaning by filtration or settling to naturalize any acid present by means of soda, or to saturate the liquid with basic phosphate of lime, the latter being preferable because the phosphoric acid required by the yeast is thus abundantly furnished to it. In order to start the growth of yeast, gelatinized starch is added after being transformed in the usual way into dextrose by boiling with an addition of mineral acids. In the place of starch thus prepared an addition may be made of maltose, molasses, or sugar mixed with beer-yeast or compressed yeast. The amount thus added should correspond to the percentage of pep-

tone in the liquid, being one-half of the dry weight of the peptone. The hydrocarbons should, however, always be only from .5 to 1 per cent. of the weight of the entire liquid, and should even then serve exclusively for the formation of the walls of the cells of the yeast.

The vegetation of the yeast will take place most satisfactorily at temparatures varying from 57 to 64 degrees Fahrenheit. At a higher temperature losses may easily occur by reason of the partial conversion of the sugar used into coagulated acid or into alcoholic fermentation, instead of furnishing the yeast with substance for cells. The yeast is either propagated, as is the custom in Holland, in shallow vessels in which the depth of liquid is about five inches, so that a sufficient quantity of atmospheric air has access thereto; or it may be better and more safely effected in vats made of wood, glass, masonry, cement, or other suitable material, into which atmospheric air is conducted by suitable distributors through tubes or pipes by means of blowers or compressers.

Instead of atmospheric air alone it is more advantageous to use air containing an increased amount of ozone or of oxygen partially converted into ozone. The latter is prepared by successively adding hydrogen dioxide to the propagated liquid. The percentage of ozone in the air is increased by means of phosphorus, or by causing it to pass through a closed vessel in which permanganate of potassa is mixed with the necessary quantity of mineral acid. The air thus enriched with ozone is then allowed to pass into the propagating liquid.

The growth of the yeast will be completed within from 6 to 8 hours after every sufficient addition of dextrose, maltose, or other material, according to the density of the propagating liquid used, the temperature of the latter, and the amount of the ozone in the air. The percentage of peptone of the mass may amount to from 1 to 2 per cent. or more of its weight, while only from one-half to one per cent. of dextrose or other hydrocarbons is added at each time, in order to be sure to prevent the formation or coagulated lactic acid or alcoholic fermentation.

When the entire amount or bulk of the dextrose or other sugar added to promote the growth of the yeast has been consumed after from six to eight hours, a further quantity thereof, say, from .05 to .10 per cent. is added. The peptone may also, after having been consumed, be added in portions, or may be allowed to flow in gradually and continuously. The same propagating liquid made by successive replacement of the matter consumed remains in use for weeks or months, unless it is rendered impure by other substances, or by subsiding fermentation is made unfit for further use. In the same manner as the materials necessary for the propogation of the yeast are added the yeast produced may be successively withdrawn, and only the yeast suspended in the liquid remains behind as the germ for the ferments of alcohol to be afterwards formed. The yeast is obtained either by skimming it from the surface of the liquid or by separating it from the propagating liquid by filtration, or finally by gathering it after tapping the vats from the bottom upon which it is deposited in a compact layer. In working on a large scale it is advisable to place the vats in terraced batteries in order to effect the transfer of the propagating liquid from one vessel to the other with facility. In order to produce yeast as free as possible from subsidiary ferments the propagating liquid may be prepared in a more dilute state, that is to say, with a percentage of peptone of only from .75 to 1 per cent. The hydrocarbons (dextrose, maltose, or the like) may also be added in smaller quantities, for example, as a first dose about .33 per cent. and then every 3 hours about .05 per cent.

The greater part of the peptone present will then be transformed into yeast in from 12 to 15 hours, a sufficient supply of pure air, if necessary, conducted through sulphuric acid or oxygen containing ozone, being provided, and the entire process being carried on at a temperature varying from 54 to 63 degrees Fahrenheit. The whole liquid is then cooled by a suitable apparatus, or by adding cold water or ice; the best temperature being from 45 to 50 degrees Fahrenheit. Within from 36 to 48 hours the yeast obtained will settle on the bottom of the vat. The propagating liquid may be allowed to flow away. The yeast obtained by this improved process is purified and condensed in the usual manner, but in order to increase its durability phosphate of lime amounting to from 4 to 5 per cent. of the total weight of the yeast to be made may be added before compressing it.

Experience has shown that from 250 to 300 parts of pure and active compressed yeast may be obtained from 100 parts of pure peptone. For the growth of that quantity of yeast only about 200 parts of dextrose or sugar are required.

MICROSCOPY.

We have received the February issue of the Journal of the Royal Microscopical Society, now edited by Mr. Frank Crisp, one of the secretaries of the society. It contains a valuable and interesting original paper, with two full-page illustrations, and the proceedings of the R. M. C. A summary is also presented of current research in those departments of science, depending upon the use of the microscope for their advancement. The amount of information thus gathered may be estimated from the fact that the present number is a volume of one hundred and seventy-two pages. The Journal appears bi-monthly, and costs one dollar (4*s*.) for each part.

The President of the Royal Microscopical Society announced that a fund had been provided for the presentation of two gold medals annually, without regard to nationality—one for the person who should originate any important improvement in the microscope, or any of its accessory apparatus, or in any other way eminently contribute to the advancement of the microscope as an instrument of research. The second gold medal was to be awarded "in respect to any researches in any subject of natural science carried on wholly, or in a great part, by means of the microscope, or of the recipient having in other ways eminently contributed to the advancement of research in natural science in connection with the microscope."

The two medals were to be known respectively as the "Microscopical" and "Research" medals of the Society. For reasons which are not stated, the offer of this fund was declined by the Council of the Society.

The war of Apertures of Microscope Objectives has again broken out in the R. M. S. In this instance Mr. Shadbolt was the aggressor, who claimed that his paper demonstrated beyond dispute the following facts, viz.:

"That a dry lens can have as large an 'angular aperture' as an immersion one, and that the assumed difference of aperture between dry and immersion lens does exist."

"That no lens can have an 'aperture' of any kind which exceeds that of 180° angular in air."

"That, consequently, the table of 'numerical apertures' published on the cover of the *Journal* of the Society is erroneous and misleading, and should at once be discontinued."

In reply, Mr. Crisp asserted that Mr. Shadbolt was in error, and the victim to a misplaced confidence in a fundamental fallacy, viz., "the supposition that equal angles in different media, as air and oil, are optically equivalent."

A correspondent, who is an authority on this subject, will offer an opinion on this matter. We believe, however, that Mr. Crisp is correct in his views, and that the society has exercised a wise discretion in putting a stop to a discussion, which had become wearisome and unprofitable.

Mr. Crisp showed how a few moss-grown English microscopists had persistently refused to countenance

the use of immersion objectives, which are now in universal use, and accepted as a valuable improvement.

The use of oil was suggested by Amici, as far back as 1844, by Oberhauser in 1845, and Wenham in 1855 and again in 1870, and only admitted in practice in 1878, so that it appears to have required 34 years to convince microscopists of a fact, that might have been settled in a week and this due to "persistence in a fallacy." Such being the case it is surely time for these fallacies to be shelved, and we are glad to find the R. M. S. has taken such a view of the case.

FLUORESCENT BODIES.

If we put some common paraffin oil, or a solution of sulphate of quinine, into a glass tube or other suitable vessel, and then look through it, the liquid will appear quite colorless; but if we allow the light to fall upon it, and then view it at a little distance and at a certain angle, some parts of the liquid will present a delicate sky-blue tinge. The effect in the case of quinine is heightened if the source of light is burning magnesium wire.

The large number of substances belonging to this class are termed fluorescent bodies, because they exhibit phenomena similar to the examples above given. The term itself, however, was suggested to Prof. Stokes by a particular kind of fluor-spar which shows this property.

Again, if we cause a room to be darkened, and allow only blue light (*i. e.*, by covering a hole in a window-shutter with cobalt-blue glass) to fall upon a glass vessel filled with water which has been standing some minutes, on floating a strip of horse-chestnut bark upon its surface, in a few moments a stream of bluish grey fluid (æsculin) will be seen slowly descending from the bark, hanging, in fact, like a bunch of barnacles from an old ocean waif. Of if, under the same arrangement of light, or by using even more powerful absorbents of the ordinary rays (such as a solution of ammonio-sulphate of copper or one of chromate of potash), we look at a piece of what is commonly termed canary glass—*i. e.*, glass colored with an oxide of the metal uranium—it will be seen to glow as it were with rich greenish yellow rays, just as though it were itself a source of light; or if we take a solution of a uranium salt (the normal acetate) the phenomena are very striking when examined under the same conditions, and still more so by the electric light. But the salts of aniline—a substance which is the parent, so to speak of mauve, magenta, and other brilliant colors—are singularly rich in exhibiting these effects.

A very beautiful experiment may be performed with the aniline red ink now so commonly in use. It affords, at one and the same time, an admirable illustration of Prof. Tomlinson's submersion figures and of the phenomena under consideration. If we take a long cylindrical glass vessel, or one with parallel sides, fill it with water, which is allowed to settle, and then gently deliver a drop of the red fluid to the surface, the drop begins to contract, and slowly from its centre descends in the form of a tube; the denser parts of the coloring-matter presently form a thick circular rim at the end of the tube,—but this is only for a moment, for a wavy edge appears upon this rim, then expands into a triangular parachute with a thickened edge, and from the extremity of each corner two or three smaller tubes descend; these in like manner pass through the same phases as the parent stem or tube.—*E. R. Hodges (Journal of Science, London.)*

INTRA-MERCURIAL PLANETS.

A collection of the observations published in the report of the Total Solar Eclipse of 1878, will give, perhaps, the best idea of the present state of the question of the discovery of Vulcan and other planets revolving within the orbit of Mercury; and it may be of some interest to present the matter in the form of a chart showing the ground covered by different observers, who, during the time of totality, devoted themselves to the search for such bodies. For this purpose, the space swept by the six observers, Newcomb, Hall, Wheeler, Bowman, Todd and Pritchett, has been indicated by different shading on the accompanying chart, which is merely a copy of that prepared by Prof. Hall for the use of observers of the eclipse, and published with the instructions issued from the United States Naval Observatory.

The two objects, "*a*" and "*b*," discovered by Prof. Watson, and thought by him to be planets, have been indicated upon the map thus: ⊙. The two discovered by Swift, also announced as intra-mercurial planets, have been marked thus: ⊗.

Swift's two stars are described as equal in brightness, of about the fifth magnitude, and 8′ apart; on a line with the sun's centre. Each had a round red disk, and each was free from twinkling. The object farther from the sun was at one time thought by Swift to be ϑ Cancri, and the other a new planet. The diameter of the field of view was 1.°5.

Watson's star, "*a*," is described as being "between the sun and ϑ Cancri, and a little to the south;" of a ruddy color and about 4th magnitude, or fully a magnitude brighter than ϑ Cancri, which was seen at the same time. The star, "*b*," was also of a ruddy hue, and is given as the 3rd magnitude.

Watson used an aperture of 4 inches; magnifying power of 45 diameters; Swift, an aperture of 4.5 inches; power of 25 diameters. We see by inspecting the chart, that the place of one of Watson's stars (that of which he was the more certain) was covered by Wheeler with a 5-inch aperture; power 100; by Pritchett, 3.5 inch aperture, power 90; and by Bowman with a 3.5 inch aperture and power of 30 diameters. The place of Swift's two stars was examined by Bowman and Wheeler, and one of the stars appears just in the corner of Pritchett's sweep. Finally, the whole ground was covered by Todd with a 4-inch aperture and power of 20.

Of these observers, Wheeler and Pritchett possessed telescopes with optical power at least equal to that of Swift, or Watson, and Bowman's glass was of sufficient power to show any object as large as the 5th magnitude,—but nothing, not already upon the chart, was found.

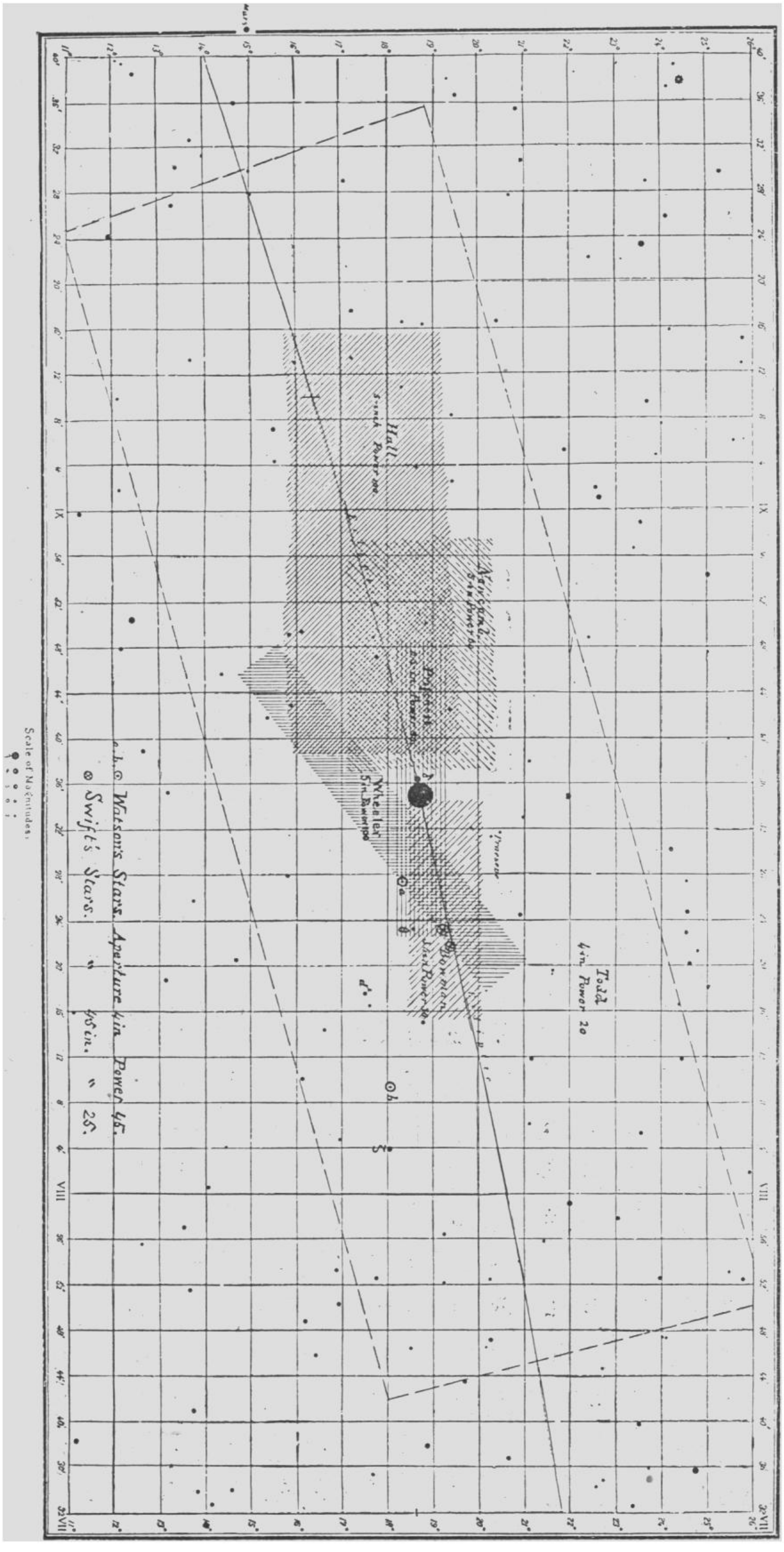
This should be borne in mind, however, that several ot the observers were enabled to make but very hasty sweeps,—not devoting so much of their attention to the subject as Watson did, and, indeed, at Mr. Todd's station clouds interfered seriously with the work. And, on the other hand, it appears that Prof. Watson devoted a large part of his time to sweeping on the east side of the sun.

A glance at the chart will show that Watson's stars have about the same relative positions and magnitudes as ϑ and ζ Cancri, and that Swift's stars as far as relative position is concerned, resemble closely d^2 Cancri and B. A. C. 2810, or the pair of stars similarly placed on the other side of the sun. The probability of an error in pointing the telescope, which would account for such a misidentification as has been suggested, has been thoroughly discussed by Dr. C. H. F. Peters in the *Astron. Nach.*, No. 2253, p. 323, and Dr. Peters' paper has been answered by Prof. Watson in the next volume, *Astron. Nach.*, No. 2263, p. 101.

It is not the intention of this article to consider again the question of the identity of the stars seen by Watson and Swift, but merely to point out the evidence upon which the discovery of "Vulcan" rests, and to call attention to the fact that the existence of an intra-mercurial planet is not yet admitted by the majority of astronomers of the present day. W. C. W.

WASHINGTON, D. C., *February* 24, 1881.

Planets and Stars in the Vicinity of the Sun, on July 29th, 1878.



TO ILLUSTRATE ARTICLE ON INTRA-MERCURIAL PLANETS.

BOOKS RECEIVED.

A MANUAL OF ZOOLOGY for the use of students, with a general introduction on the principles of Zoology—by HENRY ALLEYNE NICHOLSON, M. D., D. Sc., Ph. D., etc., Professor of Natural History in the University of St. Andrews. Sixth edition, revised and enlarged,. William Blackwood and Sons—Edinburgh and London, 1880.

This Manual of Zoology has become so fully recognized as one of the most complete and reliable guides to a knowledge of this subject, that but few words are necessary in giving notice of the issue of a new edition.

The study of Zoology is constantly bringing new and interesting facts to the surface, hence the necessity for frequent editions of manuals treating on the subject, to keep pace with discoveries. Professor Nicholson has availed himself of the present opportunity to thoroughly revise his work, and bring forward arrears of facts which have accumulated during the past two years, and in accordance with the views of many distinguished naturalists he has raised the order of *Echinodermata* to the rank of a sub-kingdom. This alteration necessitates the abandonment of the *Annuloida* as a sub-kingdom, and the reference of the Scolecida to the Annulosa.

Professor Nicholson forestalls criticism for such action by candidly admitting that this arrangement is far from being wholly satisfactory, but asks that it may be provisionally adopted as the best under the circumstances, taking into account our present knowledge.

A number of excellent illustrations have been introduced in the present edition, and the student will now have the benefit of over 450 wood-cuts.

The general plan of this book is admirable, and following each chapter is a list of the best works and memoirs relating to the animals belonging to each sub-kingdom.

There is one feature of this work which in our opinion gives it a special value to students, and that is an excellent glossary of about 1000 words. The index is also ample and carefully arranged.

The present work of Professor Nicholson is the latest and best Manual of Zoology, and we recomend it strongly to those interested in such studies.

LIFE ON THE SEASHORE, OR ANIMALS OF OUR COASTS AND BAYS, with illustrations and descriptions. By JAMES H. EMERTON, author of Structure and Habits of Spiders. Naturalists' Handy Series No. 1. George A. Bates, Salem, Mass., 1880.

This charming little work is the first of a series of handy books suitable for amateur naturalists, a class now happily on the increase.

The author has provided a pleasant companion which should be in the hands of all visitors to our coasts, ensuring a never failing fund of amusement, leading insensibly to one of the most delightful of scientific studies.

Mr. Emerton states "I have tried to give such explanations of some of our common animals of the New England coast as have been often asked for by persons little acquainted with zoology, and to give such directions about collecting and observing them as have been found useful to students who come to the shore for a short time in the summer to study animals that they before knew only from pictures."

The book is divided into four parts, treating separately animals which are found "between the tides," "near low water mark," "surface animals," "bottom animals." The reader will find this an excellent arrangement. We find above one hundred and fifty excellent wood cuts, which faithfully represent the objects described in the body of the book; the sensational and misleading illustrations to be found in a somewhat similar work find no place in this volume. We can therefore recommend Mr. Emerton's work as not only a reliable guide, but one which will create a healthful desire for knowledge in those who are so fortunate as to possess it.

CHEMICAL NOTES.

CONTRIBUTION TO A KNOWLEDGE OF SAPONIFICATION OF FATS.—The name fat is generally applied to a mixture of the tri-glycerides of palmitic, stearic, and oleic acids. As regards the animal fats this assumption has been in all cases verified, but the vegetable fats display certain not unimportant deviations. J. König, J. Kiesow, and B. Aronheim, in saponifying vegetable fats, obtained invariably less glycerine than is required for forming the glycerine-ethers of the fatty acids—a fact pointing to the conclusion that free fatty acids must be present, since the quantity of cholesterine occurring in the plants is too small to combine with the fatty acids. For saponification potassium and sodium hydrate were used along with the other basic oxides, the latter substances being considered equal in value to the former, the only difference being that the products in the one case are termed "soaps," and in the other "plasters." It was assumed hitherto that the tri-glycerides, like other ethers, were completely decomposed by the above named ethers into salts of the fatty acids and glycerine, and that equal quantities of glycerine were obtained in all cases. For the saponification of fats and the separation of the products, J. König had proposed a process which consists essentially in treating the fat operated upon with an excess of lead oxide in presence of water at 90° to 100°. Dr. von der Becke, when attempting at his request to saponify cacao-butter in this manner—in order to discover a process for detecting the sophistications of this product—found that it could not be saponified with lead oxide, at least not in this manner. It was found on further experimentation that the quantity of glycerine obtained on saponification with potassium hydrate was in all cases considerably the highest. In the easily saponifiable fats, butter, lard, and olive oil, the difference was found less manifest, but it was much more distinct in those which are hard to saponify. Cacao-butter and tallow, if saponified with lead oxide, yield scarcely traces of glycerine. A mixture of an easily saponifiable fat like butter with cacao-butter gave the same quantity of glycerine as if butter alone were employed. It is possible that the reaction when once set up may extend itself. Hence it appears that in the case of some fats the method of saponification with oxide is not trustworthy, and that when the accurate determination of the proportion of glycerine in a fat is required, the saponification must be effected with potassium hydrate.

CONTRIBUTIONS TO THE CHARACTERISTICS OF THE ALKALINE EARTHS AND OF ZINC OXIDE.—The alkaline earths and zinc oxide if their hydrates, carbonates, and nitrates are heated to complete decomposition, are obtained in the following specific gravities. Lime is obtained amorphous from the hydrate and carbonate, but in regular cubic crystals from the nitrate; in either case of the sp. gr. 3.25. Strontia is obtained from the hydrate and carbonate amorphous, and of sp. gr. 4.5, but from the nitrate in regular crystals and of sp. gr. 4.75. Baryta is obtained from the hydrate in optically one- or two-axial crystals, of sp. gr. 5.32: but from the nitrate in regularly cubic crystals of sp. gr. 5.72. Magnesia is always obtained in the amorphous form of sp. gr. 3.42. Zinc oxide is obtained amorphous from the hydrate and carbonate of sp. gr. 3.47, but from the nitrate in hexagonal pyramids of sp. gr. 5.78.

Prof. Pritchett, of the Morrison Observatory, Glasgow, Mo., has made arrangements to drop a Time-Ball at Kansas City.

DETERMINATION OF SILICON IN IRON AND STEEL.—One grm. iron or steel is placed in a porcelain crucible with 25 c.c. nitric acid of 1.2 sp. gr. When the reaction is over 25 to 30 c.c. dilute sulphuric acid—1 part acid and 3 water are added, and the solution is heated till the nitric acid is entirely or nearly expelled. When the residue is sufficiently cool water is cautiously added, and the contents of the capsule are heated till the crystals are perfectly dissolved. The solution is then filtered as hot as possible, and the residue washed first with hot water, then with 25 to 30 c.c. hydrochloric acid of sp. gr. 1.20, and finally again with hot water. After drying and ignition the silica is obtained snow-white and granular.—T. M. BROWN.

SCIENCE:

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